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A GREEN REPOSITORY MATURES AT KEPONG : THE FOREST RESEARCH INSTITUTE OF MALAYSIA

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ABSTRACT

An overview of the history of establishment, characteristics and functions of the grounds of the Forest Research Institute of Malaysia at Kepong is presented. The Institute was functionally established at its Kepong premises in 1926, when the first forest plantations there were begun, and the arboretum was established in 1929 through the efforts of F. W. Foxworthy and J. G. Watson. Today, the premises at Kepong occupy a total area of some 600 hectares, including the natural forest of Bukit Lagong, the plantation forests and the special living-plant collections. The planted forests are a prime example of tropical reforestation using hardwood dipterocarp species. These plantations and the arboreta have been built up through a close association with research related to forestry, plant biology and taxonomy, and the grounds are an important facility for conservation, education and recreation. Taken *in toto*, the entire premises are effective in conservation through the building up of viable, breeding populations of many plant species, and are significant as a sanctuary for animal life.

Unlike the Indian Botanic Garden, which by 1987 would have celebrated two hundred years since establishment, the Kepong premises of the Forest Research Institute of Malaysia will see its bicentenary only in the year 2126. It seems a long way to go, and indeed it is. But botanic gardens and arboreta do not grow merely with age; they will only develop with continual maintenance, acquisition and renewal through time. It is, therefore, most pleasing to realize that the Indian Botanic Garden has been sustained for two centuries, and the Kepong premises is maturing after sixty years, as scientific living-plant repositories.

The living collections on the Kepong premises of the Forest Research Institute of Malaysia (FRIM) have not normally been equated to a botanical garden in its typical sense because of the general emphasis on arboriculture and species of interest to tree-oriented forestry. Although they are as purposeful and functional as any botanical garden in the tropics, the grounds of the FRIM are unique in several aspects and are well-recognised by tropical plant scientists as one of the major repositories for living plants in the region.

THE ESTABLISHMENT OF THE LIVING COLLECTIONS AT KEPONG

In 1923, senior officials of the Government of the Straits Settlements and the Federated Malay States in Malaya had discussed the centralization of botanical work under a new department distinct from the Department of Agriculture in the growing administrative centre of Kuala Lumpur. Although the decision was taken to move the Singapore Herbarium, as well as work in systematic and economic botany carried out at the Singapore Botanic Gardens, to Kuala Lumpur, and to develop the Public Gardens in Kuala Lumpur as the principal garden, these plans were never fulfilled. The slump in rubber prices in 1924 affected revenue adversely and the failure to transfer the resources of the Singapore Herbarium to Kuala Lumpur (where the new botanical department was to have been known as the "Botanical Survey, Malaya") made it necessary for the Forest Department to create its own specialist facilities (Burkill 1983).

Although the decision to set up the Forest Research Institute was first taken in 1921, it was not until August, 1925, that a request was made to the Regent of Selangor State to allocate 324 hectares (about 800 acres) at Kepong for siting the institute. In 1926 the Forest Research Institute was functionally established at its Kepong premises with the beginning of a forest nursery and several experimental plantations. In 1928, the Forest Economist James Gilbert Watson approached the Forest Research Officer Frederick William Foxworthy to volunteer the establishment of an arboretum (departmental correspondence, No. 3 in F.E. 93/27 dated 23rd September) which, as he noted, "apart from its scientific values.... will.... demonstrate our ability [as foresters] to grow trees at a price, and thereby emphasize the difficulties with which we are faced in the field." Watson suggested that "one third of the area be definitely dedicated to the dipterocarps, and a small portion to exotics" and that "belukar [secondary forest] forms, and trees that are commonly found and are easily accessible elsewhere at Kepong, will not ordinarily be planted;" also "generally speaking......the commercial trees will take precedence if space is at all cramped." Planting for the arboretum began in 1929.

It was, however, not such a straightforward task to build up the plantings at Kepong. Watson (1935) wrote: "The areas available for planting consisted of abandoned [tin] mining land that had first been cleared of forest, then mined by Chinese open-cast and gravel pump methods, resulting in portions of it being covered with the overburden and refuse removed from the mines, then grazed by cattle, cultivated by Chinese vegetable gardeners and abandoned and grazed again until whatever merit the surface soil may have had was leached well out of it." The existing vegetation when planting commenced was a mixture of patches of open *Imperata* grassland, secondary forest and forest disturbed by woodcutting that formed the lower reaches of the Bukit Lagong Forest area. Much of the plantation establishment was carried out by first creating an overhead matrix formed of hardy (mostly leguminous) tree species followed by underplanting with indigenous species. Since then, the plantations have undergone various silvicultural treatments and replacement of trees to produce the present species stands. Today, the oldest of these plantations are 60 years old. The arboretum planting was carried out along lines cut into the secondary forest existing in the selected areas and only after the cultivated plants have started to surpass the general height of the secondary forest trees were the areas maintained clear of secondary growth.

THE GROUNDS TODAY

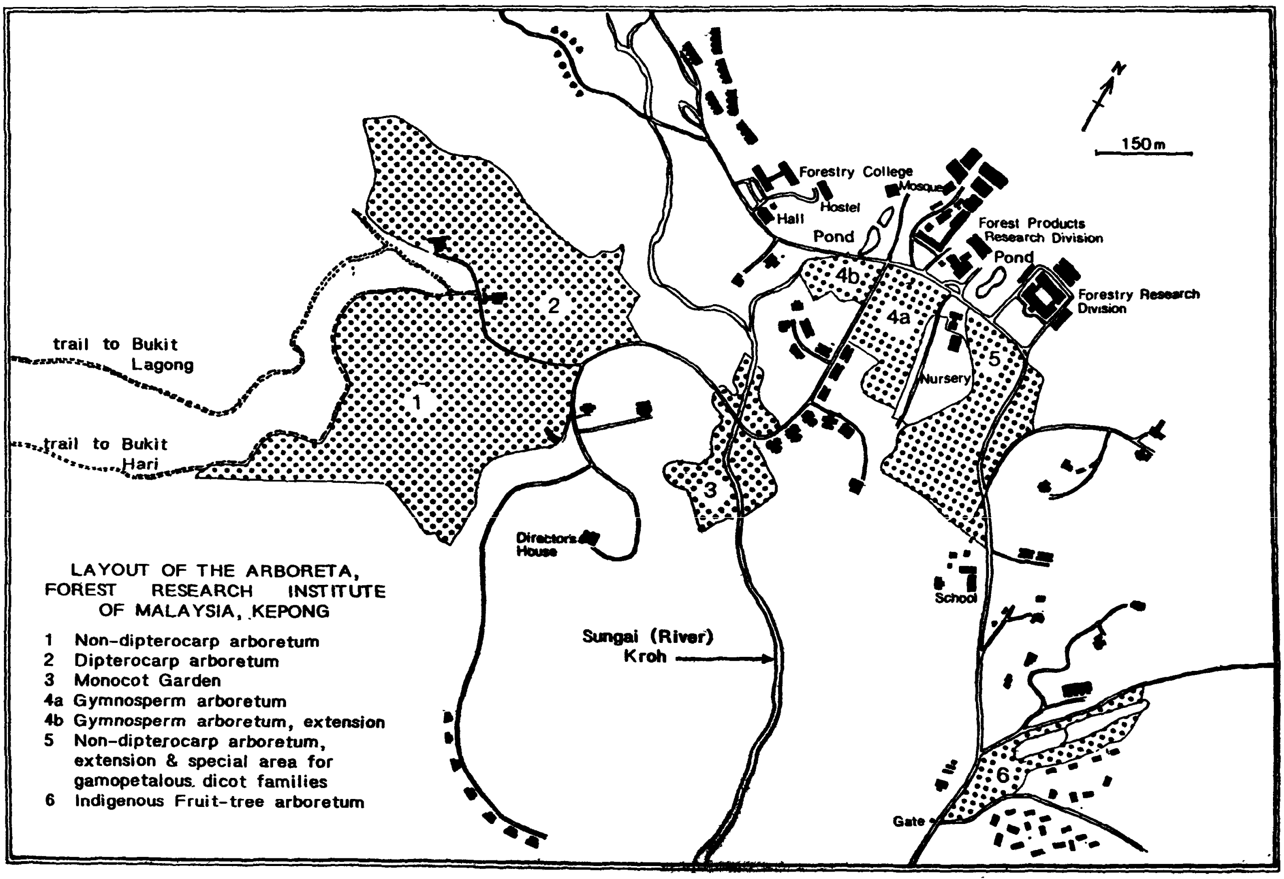
The grounds of the Forest Research Institute of Malaysia (FRIM) at Kepong today occupy some 600 hectares (about 1500 acres) of the southern foothills of the Bukit Lagong Forest Reserve. This area includes the natural lowland and hill dipterocarp forests of Bukit Lagong as well as the plantations and arboreta. The entire grounds, and not merely the arboreta alone, must be considered effectively a botanical repository.

At the last inventory in 1984, which enumerated only planted trees, the dicotyledonous and gymnospermous plants were represented by 77 families including 474 species indigenous to the Malay Peninsula (some 19% of the indigenous tree flora of the Malay Peninsula) and 185 exotic species. In addition to this, there were planted 57 indigenous and 6 exotic species of bamboos, palms and pandans (Tho *et al.* 1984). The collection

Aerial view of part of the grounds of the Forest Research Institute of Malaysia (taken in 1985) showing the building complexes nestled within a matrix of natural and planted forests.

The lily-pond beside the administrative complex.

The administration building, completed in 1929, now guarded by mature specimens of *Casuarina rumphiana* at its front.

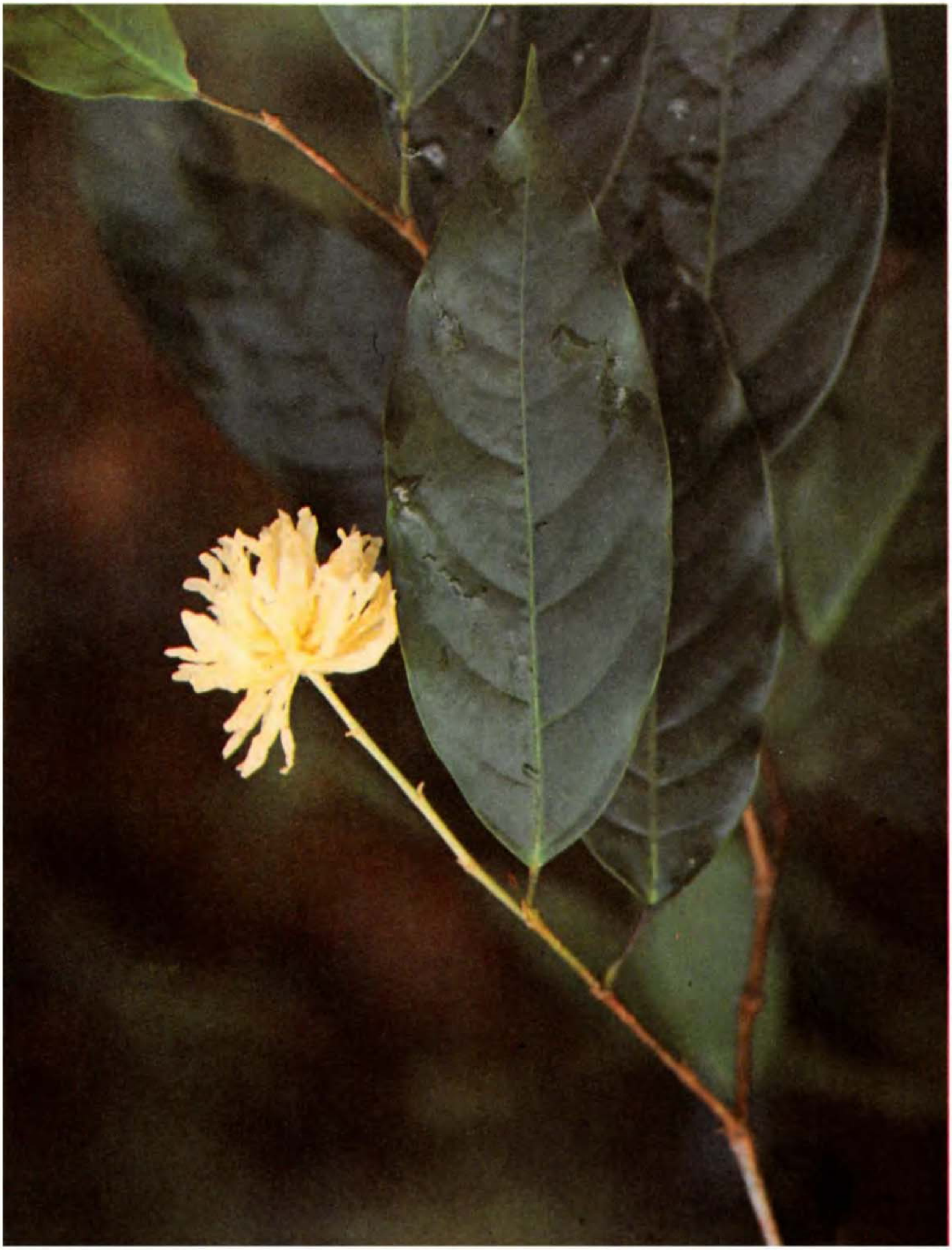


LAYOUT OF THE ARBORETA, FOREST RESEARCH INSTITUTE OF MALAYSIA, KEPONG

1 Non-dipterocarp arboretum
2 Dipterocarp arboretum
3 Monocot Garden
4a Gymnosperm arboretum
4b Gymnosperm arboretum, extension
5 Non-dipterocarp arboretum, extension & special area for gamopetalous dicot families
6 Indigenous Fruit-tree arboretum

Part of the Gymnosperm living collection, established at its existing site in 1949.

Established in 1929, the Dipterocarp Arboretum is the main pride among the various living collections at Kepong.



Maingaya malayana, a monotypic species endemic to the Malay Peninsula and once thought extinct, exists now in the sanctuary of the Forest Research Institute of Malaysia, raised from seed collected in 1971

Growth-trial plot of the rattan *Calamus trachycoleus*, native to Kalimantan Borneo, at the Forest Research Institute of Malaysia.

is biased towards certain plant families, in particular the Dipterocarpaceae, which is Southeast Asia's principal timber-tree family. Of Peninsular Malaysia's 157 known dipterocarp species (Ashton 1982), 103 (or 65%) are represented as living specimens on the Kepong premises; an additional 28 species of Bornean origin are also planted. Twenty of the 48 species of bamboos known to occur in the Malay Peninsula also exist as live specimens at Kepong.

The living collection, apart from those 248 species in plantation trials (Selvaraj & Muhammad 1980), includes the Dipterocarp Arboretum (6.5 ha), the main Non-dipterocarp Arboretum (11 ha), a special area for gamopetalous dicot families (1.5 ha), an Indigenous Fruit-tree Collection (0.6 ha), a Monocot Garden (1.5 ha) and a Gymnosperm Arboretum (2.5 ha). Other than these designated areas, many other species have also been planted within and around the central building complex.

The functions of botanical gardens and living-plant repositories are varied and directly applicable to not just the science of plant taxonomy and conservation but also to so-called applied disciplines such as forestry, agriculture, landscaping and plant propagation (*e.g.*, Stone 1977). We are fortunate that today the grounds of the Forest Research Institute of Malaysia at Kepong serve, more than ever, to be the prime Malaysian example for these functions.

FORESTRY

One of the most important aspects of the grounds at Kepong is that it serves as excellent testimony to the fact that degraded tropical land can successfully be rehabilitated and reforested. There are areas planted with fast-growing exotics such as *Pinus, Araucaria, Acacia, Maesopsis* and *Paraserianthes* ("Albizia"), but the more significant fact is that there are a great many indigenous hardwood dipterocarp species planted which have now matured to form the woods on the premises, such as *Neobalanocarpus heimii, Dipterocarpus* spp., *Shorea* spp., *Dryobalanops* spp. and *Hopea* spp. Dipterocarps are the principal trees of most of Southeast Asia's forests and supply much of the hardwood timber harvested; as concern grows over diminishing natural forest areas (*e.g.*, Myers 1984) and vegetation scientists and foresters alike struggle to examine options and techniques for reforestation there is at least some example that rebuilding the forest with dipterocarps has been possible.

These man-made forests, so to speak, are not merely silvicultural trials but are also a source of seed for raising planting stock for the different forestry programmes, ranging from enrichment planting programmes in natural forest stands to urban planting schemes. The grounds at Kepong have often served as the "first stop" for species introduced from the wild, and grown under observation before being recommended for use in particular situations. Through its general sales, the Institute's nursery popularises the use of suitable indigenous trees for urban planting, in the effort to enrich the host of wayside trees that can be made familiar to Malaysians in an increasingly urban lifestyle, in a country admired for its rich plant life.

PLANT BIOLOGY AND TAXONOMY

The forest plantations, plots and arboreta have, over the years, yielded much information through observations carried out on the growth rates of indigenous trees (Ng & Tang 1974; Ng 1979), vegetation succession (Symington 1933; Wyatt-smith 1949; Kochummen & Ng 1977), reproductive phenology of trees (Ng & Loh 1974; Ng 1977, 1981), plant architecture (*e.g.*, Halle & Ng 1981; Wong & Lim 1983;

Wong 1984; Edelin 1984) and the insect life associated with these plants *(e.g.,* Tho 1978a, 1978b, 1979, 1982).

The planted specimens have also greatly facilitated research on seed and germination biology *(e.g.,* Ng 1980; Yap 1981) and rattan silviculture *(e.g.,* Aminuddin 1984). In spite of this, these grounds at Kepong are useful to science only because the research carried out at the Institute seeks to draw information from the plant and animal life maintained and protected within the premises.

Plant taxonomic studies have always figured strongly in the history of the Institute. The first Forest Research Officer of the Straits Settlements and Federated Malay States, Foxworthy, had worked principally as a botanist at the Bureau of Science in Manila previous to his engagement in Malaya Foxworthy had realised from the beginning the importance of making a systematic inventory of the trees and himself set out to study the Dipterocarpaceae (Foxworthy 1932). Following in this endeavour and in the example of Symington's excellent monograph of Malayan dipterocarps (Symington 1943), Kepong botanists have continued, one world war and generations later, to study the non-dipterocarp tree families towards producing a Tree Flora of Malaya,of which three volumes have so far been accomplished (Whitmore 1972; Whitmore 1973; Ng 1978). The Tree Flora project is the principal taxonomic effort at Kepong, although a taxonomic monograph on Malayan rattan palms has been produced (Dransfield 1979) and a revision of the bamboos is in progress. All these efforts have, to some extent, depended on or improved the living plant collections at Kepong.

Various botanists have had the opportunity to describe new species based on specimens planted on the grounds of the Institute, when these plants came into flowering and reproductive material became available for proper diagnosis Thus the bamboo *Schizostachyum jaculans* (Holttum 1953) and the pandan *Pandanus albifrons* (Stone 1983) are represented by living type plants on the Institute's premises. The type clump of another bamboo *Gigantochloa rostrata* (Wong 1982), which perished after flowering, is survived by offspring also growing on the premises.

CONSERVATION

Most living-plant repositories are collections of species that are mostly represented by only one to several planted individuals, and at best with a few species planted as avenues. In many cases, the few individuals are offspring from the same parent. At Kepong, as in many large gardens around the world, the emphasis is not on merely extending the list of planted species but also on "duplicating" a living specimen through growing, as far as possible with seed from different sources, a number of individuals so that the death of one will not mean the loss of representation of a species in the collection. If the aim of *ex situ* conservation is to keep alive a species then some thought must be given to keeping a sufficient number of individuals to increase the chances of having a viable, breeding population. The living collections are supplemented on the same premises by the natural forest of Bukit Lagong, on which a great number of species and habitats are conserved. Here, on Bukit Lagong itself, is sited one of the oldest studied vegetation plots in these tropics where periodic monitoring of growth rates and population changes, and of species loss and gain, is continued.

As stated earlier, the entire premises of the Forest Research Institute of Malaysia at Kepong is considered a conservation area with natural forest and repositories for living plants. The species growth trials and the different provenances are perhaps more effective ways of conservation than the planting of lone individuals and certainly many species are in this way "safe" The Bornean Ironwood *(Eusideroxylon zwageri),* as an example, is represented at Kepong by stands within which seed regeneration is regular and predictable.

In other cases it may not be as straightforward. The discovery that *Litchi chinensis* occurred naturally in some forests of the Malay Peninsula (Yap 1983) was soon followed by the realisation that there were at least two such trees in the Bukit Lagong forest. Even then, the species appeared to be rare and seed collected from another natural source have been germinated to provide seedlings for planting within the Institute's grounds. The successful propagation of wild stock of *Litchi chinensis,* hitherto not known to occur in the wet tropics, may in future bring the opportunity for the breeding of selected characteristics desired by horticulturists and pomologists. Another, even rarer species, *Maingaya malayana,* was similarly introduced to Kepong through the successful establishment from seed of two plants, which eventually gave rise to further seed offspring (Ng 1984) that now adorn a stretch of lawn at the Institute.

The concept of the Kepong grounds as a sanctuary may be equally applied to animals. The return of closed-canopy conditions to the planted stands of trees around the central building complex and arboreta have encouraged the appearance of many forest birds, and mammals such as the giant squirrels *(Ratufa affinis* and *R. bicolor),* the slow loris *(Nycticebus coucang),* the flying lemur *(Cynocephalus variegatus),* the Malayan serow *(Capricornis sumatrensis),* and the bats *Cheiromeles torquatus* and *Tadarida mops* (Tho 1974) have also been sighted. The insect life, especially in terms of moths and butterflies (Tho & Mahyudin 1982), is abundant and diverse.

EDUCATION AND RECREATION

The arboreta are used for instruction in dendrology by the staff of the Forestry Department, the Forest Research Institute of Malaysia and Institutions of higher learning in the country. The great diversity of trees represented on the grounds have also proven useful for university students receiving field training in tropical plant architecture and taxonomy. Aside from these, there are numerous other visitors and school groups that are exposed to the living collections, which very often serve as their first introduction to tropical forest trees and the functions of plant repositories.

The Kepong grounds have also served as a forest park, and are frequented by visitors as a recreation. These general visitors are allowed to hike along the trails through plantation and natural forests and many also engage in birdwatching and exercise. Youth groups are occasionally allowed to camp on the premises, away from the living collections and research facilities. The Institute's forests and grounds are increasingly appreciated as a suburban natural sanctuary, just 16 km northwest of the city centre of Kuala Lumpur. As more Malaysians come to learn about this natural heritage, the Institute and the scientific value of the grounds, there is great promise that the sanctuary will live on.

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